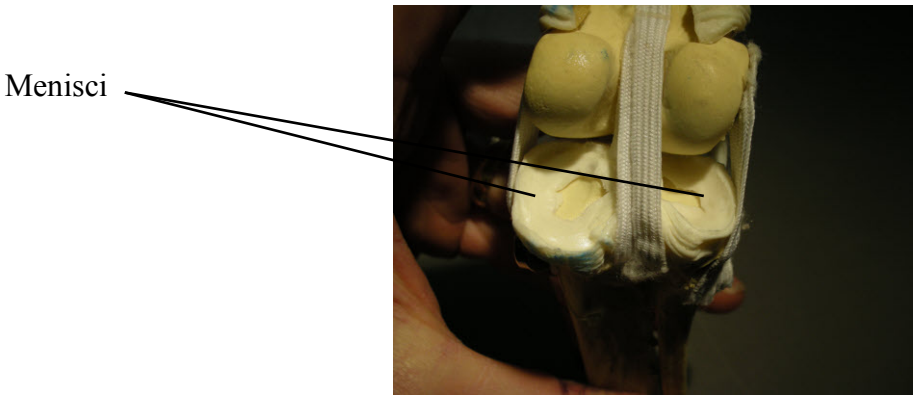
Cruciate disease in dogs

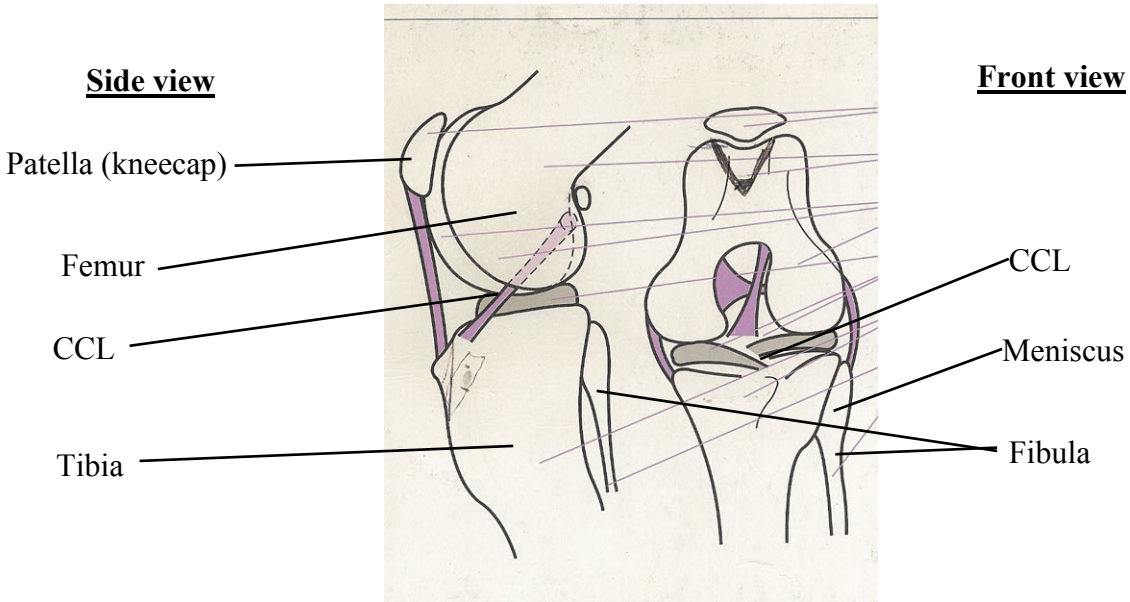
The stifle (knee) joint of a dog is a complex hinge joint. There is actually very little contact between the femur (thigh bone) and tibia (shin) bone, and the joint is thus inherently very unstable when compared with a structure like the hip, which is a ball and socket. The ligaments of the knee and the muscles around it are therefore very important in keeping the joint stable, and damage to 1 or more can be quite disabling.

In addition, there are 2 menisci (cartilages) inside the joint that are wedge-shaped and curve around the bones, spreading the load around but also markedly increasing the stability of the joint. Imagine a golf ball on a table – it is free to roll around if the table tilts. Now imagine it sitting in a golf tee – it is much more stable, and this is an important function of the menisci.



Plastic model of a dog's knee, seen from the back

The ligament that is most commonly damaged in dogs is the cranial cruciate ligament, or CCL. This is known as the anterior cruciate ligament (ACL) in people but is essentially the same structure. It runs from the back of the femur to the front of the tibia, and its main function is to prevent the tibia moving forward. It has an important secondary role in helping to prevent internal rotation (twisting) of the tibia. Unfortunately, approximately half of the dogs that have ruptured the CCL also tear a meniscus as it gets squashed between the 2 bones. This further destabilises the joint as well as causing more pain. Because the meniscus has no blood supply where it usually tears, it never heals, so we can only remove the damaged part.



In people, the ligament is usually damaged by an injury, and is a common problem for sportspeople, particularly football players and skiers. In dogs, however, the situation is very different. The vast majority of cases are caused by degeneration and a gradual weakening of the ligament, so that it fails eventually with a fairly minor injury – often just running round the garden. We do not fully understand all the causes, though there are many theories including a steep angle to the joint surface (tibial plateau angle – normal is up to 25 degrees), a straight-legged stance such as seen in some breeds, or a failure of the appropriate muscle group to protect the ligament if it is being stretched. In the case of the CCL, this muscle group is the hamstrings. Overweight dogs and certain breeds do seem to be especially prone to CCL rupture.

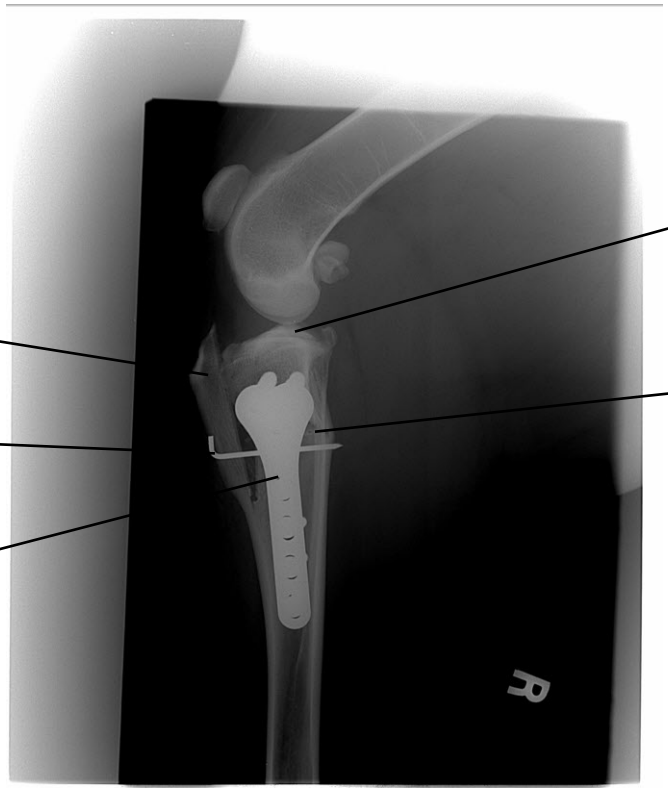
This degeneration is important for 3 reasons:

- Firstly, the ligament has been failing for months or even years in many cases before it finally gives way, so the knee joint is usually already arthritic by the time a diagnosis is made.
- Any repair method will be subjected to the same strains as the original ligament, and will probably fail prematurely.
- In many cases, the other knee is affected by the same degenerative process, and the CCL is likely to fail, particularly in young dogs and so-called giant breeds.

People, unless they are very active, often manage surprisingly well without surgery, relying on physiotherapy to strengthen the hamstrings. This does not seem to work well for dogs however, and surgery is usually advisable. There have been well over 100 different techniques reported in the literature to treat cruciate disease, which basically means that there is no single, perfect technique! Having said that, modern surgical procedures do seem to offer a better outcome both in the short and long term with better use of the limb, more muscle development (which suggests more use due to less discomfort), and a reduced or even absent progression of arthritis.

Our preferred technique relies on the muscles around the joint, particularly the hamstrings, to keep the joint stable. Basically, we make three cuts in the tibia and change the shape a little. This is called a triple tibial osteotomy, or TTO, and is a 3rd-generation development of the tibial plateau levelling operation (TPLO). We take out a wedge of bone below the knee to reduce the angle of the joint, which reduces the tibial plateau angle by about 2/3rds. Effectively, this means that when the dog is standing the plateau is sloped a little forwards, so that weight-bearing tends to push the tibia backwards. In addition, because there is another cut behind the tibial tuberosity, the wedge cut does not go all the way through to the front of the tibia. This means that, when the upper segment is bent down to close the wedge, it pushes the tuberosity forwards, so that the patellar tendon pulls in a slightly different direction and does not tend to pull the tibia forwards. Finally, because the tibial plateau angle has changed, the same amount of muscle tone (pull or tension) will keep the tibia pulled back more easily – it is pulling against less of a slope. Muscles are under some tension all the time, so this is normally enough to stabilise the joint following a TTO.

If that all seems a bit complicated, that's because it is, though the principles are straightforward! Hopefully the picture below will explain it a little better.



This patient is a 13 and a half stone Mastiff!

The technique is not perfect, though works well for the majority of cases with most dogs returning to good exercise levels after an initial recuperation period of 6-8 weeks to allow the bones to knit. The disadvantages are that the tibia can still move forward under heavy use as no artificial ligament is put in (this would increase the surgical time and infection rate, and would probably break within a few weeks or months anyway), and it does not prevent the internal rotation. However, most dogs, as long as there are no other damaged structures in the joint still seem to have good, pain-free use some years later. As for how long, the technique has only been around for 4 years or so, so we simply cannot know if it will work for 5 or 10 years or more. Unfortunately, those dogs with meniscal tears do seem to have slow progression of their arthritis, although again most 'do well'.
After admission, depending on the timing of the procedure, your pet will be given a premed containing 2

Same patient, 18 months later.

painkillers and a tranquilliser – this smoothes the induction and recovery from anaesthetic, and reduces the amount of anaesthetic required. A drip line will be set up for intravenous fluids and more drugs (painkillers, antibiotics, stomach lining protectors). We normally try to clip most of the fur from the leg before the anaesthetic is given once the premed has taken effect as this reduces the time that he or she will be anaesthetised, but this is sometimes not possible in a wriggly or ticklish pet! We do clip a wide area to reduce the possibility of contamination that might cause a post-op infection. Patches containing fentanyl (an opioids painkiller) are applied to the skin, usually over the chest. We usually take further x-rays to measure the joint angles at this point to allow us to plan the operation. We give the leg and lower back a good clean with antiseptics, and then move into theatre to finish the preparation.

Under the anaesthetic, an epidural injection of local anaesthetic is given – this blocks all pain signals from reaching the brain, and means we can reduce the anaesthetic depth. This is safer for the patient, and also seems to mean that they are more comfortable later on, long after the epidural has worn off. It seems to be that if the brain is completely unaware of what is happening (even under a general anaesthetic pain signals still reach the brain, you are just not consciously aware of them) then there is a much-reduced response to the pain. This reactive phenomenon is known as 'wind-up' and can be easily appreciated in people too – if you drop something heavy on your foot, it hurts. However, a while later the area around the initial injury is also painful.

The final cleaning of the limb is performed with 3 different antiseptics. The surgeon, having scrubbed up, dons a sterile disposable gown and gloves and drapes the op site with 3 layers of sterile disposable drapes. At this point, in larger dogs, we prefer to insert an arthroscope (camera) into the knee joint to inspect the ligament and menisci, and remove any damaged portions, as this causes less damage to an already damaged joint. Unfortunately, the knee of a dog is much smaller than that of a person and it is common for us to have

to open the knee fully to deal with meniscal tears right at the back of the joint, although new instruments are being developed all the time so this situation should improve.

Once a skin incision is made, we change instruments and gloves to reduce the chances of infection, as it is not possible to fully sterilise the patient's skin. After this, the 3 cuts are made in the tibia, the bone is bent to its new shape, and a plate & screws plus a pin are inserted to hold everything in position. In older dogs, the bone is less flexible and tends to break – this normally is of no great consequence but does make the surgery more fiddly and the recuperation a little longer. Having said that, older patients tend to take a little longer to heal anyway. Everything is then sewn up, the leg is covered in a dressing to reduce swelling and potential contamination of the wound, and x-rays are taken to check that the position of the implants is good and that the angles are correct. In all, the whole process takes about 3 hours.

Post-operatively, patients normally stay with us overnight on a morphine drip. In addition, the epidural usually means that both back legs do not work very well for several hours, and the patient tends to be incontinent for this time so we place a urinary catheter to prevent any soiling. A check-up at your local practice is normally arranged for a day or 2 later, and the skin staples are removed 10 – 14 days post-op depending on how quickly the wound heals. Painkillers will be continued normally for at least 3 weeks. We normally like to take x-rays again at 4 weeks post-op to ensure that nothing has moved and healing of the cuts is taking place. Please note that the cost of these is not included in the initial cost of the surgery. The patient will need to be kept on the lead whenever outdoors for the 1st few weeks, and steps/stairs plus slippery floors should be avoided if possible. We do not, however, recommend cage rest or sedation.

Complications inevitably can occur following such a major operation. Most are classed as 'minor' and include bruising, fluid swellings and some discomfort in the days following surgery. Just as with all drugs, some patients may get a tummy upset from the painkillers. Most of these complications can be treated effectively or resolve on their own. Major complications, fortunately, are much less common but include breakdown of the wound (usually caused by the patient being allowed to lick or chew the site), deep infections necessitating removal of the implants later (less than 1% of cases in our hands), and moderately severe pain. Again, this last complication is uncommon but seems to happen in some patients that are very overweight and may be caused by the epidural injection not going in quite the right place – it can be very difficult to feel for the correct spot and hitting a 2mm gap with a 70mm long needle can be challenging. Pain is distressing for all concerned, and we do our absolute best to prevent it as far as possible in the first place. One of our surgeons broke his tibia and knee joint skiing a few years ago, and has first hand knowledge of how unpleasant it can be.

We are thus always keen to use the most effective regimes possible. It should be noted that most of the pain-killing drugs given are not actually licensed for use in dogs, but we are permitted to use them under the so-called cascade system. Using just the ‘official’ ones would be insufficient for most cases unfortunately.

It’s easy to say, but try not to worry – most cases go very smoothly with and heal uneventfully. We are all pet owners here, and appreciate what a worrying time it can be to leave a much-loved member of the family behind, so everyone gets plenty of cuddles in addition to the actual operation!